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1. Proposed by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Three persons *A*, *B*, *C*, throw with three dice. They each stake \$10.00 and the one who first throws at least ten with the three dice takes the whole stake. Find the expectation of each.

2. Proposed by O. S. KIBLER, Superintendent of Schools, West Middleburg, Logan County, Ohio.

What is the average area of a triangle formed by joining any angle of a square with any two points within the square?

3. Proposed by MISS LECTA MILLER, B. L., Professor of Natural Science and Art, Kidder Institute, Kidder, Missouri.

A deer, wounded at the corner of a square park, is equally liable to run in a straight line in any direction, from the corner of the park, and, at the same time, is also equally liable to drop dead before running a distance equal to the diagonal of the park. What is the chance that the deer will drop dead in the park?

MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

PROBLEMS.

1. Proposed by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

To divide the arc of a cycloid into eight equal parts.

2. Proposed by SYLVESTER ROBINS, Long Branch Depot, New Jersey.

Give the dimensions of thirteen rational trapezoids each one having 1885 for its parallel bisector; and as many more wherein each bisector is 1105.

3. Proposed by J. A. CALDERHEAD, Lima, Ohio.

Given the simultaneous angular velocities of a body about the principal axes through its center of inertia, find the position of these axes in space at any assigned instant.

4. Proposed by J. K. ELLWOOD, A. M., Principal of Oelfax School, Pittsburg, Pennsylvania.

I have two circular grindstones, each $\frac{1}{2}$ in. thick. One is 6 in. and the other $4\frac{1}{2}$ in. in diameter, the aperture at center of each being $1\frac{1}{2}$ in. If when in motion they are continually tangent to each other, and $\frac{1}{2}$ cu. in. is ground off the larger wheel and $\frac{1}{2}$ cu. in. off the smaller in the first hour, how must their speed be increased so that the same amount per hour may be ground off each wheel until one is worn out? If in the first hour the larger wheel makes *a* revolutions, and the smaller *b*, how many must each make in each succeeding hour?

QUERIES AND INFORMATION.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

The definition of the root of an equation is that it must satisfy the equation if substituted in it, that is, that it must produce an identity. But in the equation

$\sqrt{x+1} - \sqrt{x-4} = 4$, the value 5, which we get by solving, does not produce an identity. Please explain.

L. B.

Answer: A square root, or any even root, calls for the double sign. The value 5 satisfies the equation if the second radical is taken with the negative sign, that is, if it assumes the form $\sqrt{x+4} + \sqrt{x-4} = 4$. Under this more general aspect, viz.; that an even root has *two* signs, the value 5 is correct; as soon, however, as you restrict such radicals to one sign, viz.; that originally given, the value 5 is to be rejected, and the solution becomes impossible.

For instance, take $\sqrt{x+a} \pm \sqrt{x-a} = a$, where a is any whole number. Solving we get $x = \frac{a^2+4}{4}$, and substituting we get, $\frac{a+2}{2} \pm \frac{a-2}{2} = a$ or 2, according as we use + or - sign. From which we see that if $a=2$ either sign will give us a value of x that will satisfy the equation.

If $a > 2$, the value of $x=a$ when the + sign is used will satisfy the equation, while if - sign is used the value of the algebraic sum equals 2 or a value less than a .

If $a < 2$, the value $x=a$ will satisfy the equation for the - sign, while for the + sign the algebraic sum will be greater than a .

In the example, $a=4$, a value greater than 2, and we get $\frac{4+2}{2} - \frac{4-2}{2} = 2$.

J. M. C.

"It is claimed that $\frac{1}{11}$ is the probability required in the following problem: There are 30 numbers, 1, 2, 3, 4, etc., in a box from which 6 numbers are drawn at random. What is the probability that the numbers 5, 7, and 12 will be included in the 6 numbers?

I would like to see a full explanation of it, if it is true.

W. L. HARVEY, Portland, Maine.

Solution.—The number of combinations that can be formed from 30 numbers, taking 6 at a time, equals the number of ways six numbers can be drawn from 30 numbers. \therefore the number of ways 6 numbers can be drawn from 30

$$\text{numbers} = \frac{30. 29. 28. 27. 26. 25}{1. 2. 3. 4. 5. 6} = n$$

If the numbers 5, 7, and 12 are taken out their still remain 27 numbers. The number of ways that 6 numbers can be drawn from 30 numbers, including 5, 7, and 12, equals the number of ways 3 numbers can be drawn from 27 numbers, and making up the 6 numbers by taking 5, 7, and 12 with each set of 3 numbers drawn.

\therefore The number of ways that 6 numbers can be drawn from 30 numbers, including 5, 7, and 12 = $\frac{27. 26. 25}{1. 2. 3.} = n'$. The required probability = $p = \frac{n'}{n}$.

$$\therefore p = \frac{27. 26. 25}{1. 2. 3} \times \frac{1. 2. 3. 4. 5. 6}{30. 29. 28. 27. 26. 25} = \frac{4. 5. 6}{30. 29. 28} = \frac{1}{203}, \text{ or}$$

the odds are 202 to 1 against the event.

J. M. C.

[In answer to Wm. E. May, Jonesboro, Tennessee, we shall endeavor to present in the several issues of the Monthly for 1894 matter of the kind that you suggest. You may be interested in Prof. Durell's article in this number.] J.M.C.